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Article

Morphometric Indicators of Spermatozoa in Rabbits of Different Ages

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Annotation: This article determines the influence of the animal's age on the morphometric parameters of spermatozoa in sperm obtained from male rabbits. For this purpose, three groups were formed: the first group at one year of age; the second group is from 2 to 3 years of age; the third group is over 3 years old. From each group of rabbits, 5 smears were prepared and morphometric parameters of spermatozoa were determined, such as: head length; head width; neck-tail length; length of the entire body in micrometers (μm).

Keywords: rabbit, age, sperm, morphometry, shape

1. Introduction

Sexual reproduction is very important from a biological point of view. Its advantage over asexual reproduction is that it allows the combination of genetic traits from the father and mother. In this regard, the offspring will be more adapted to the environment compared to their parents. Sexual reproduction occurs through gametes. The reproductive cells of male animals – spermatozoa are much smaller in size than the reproductive cells of female animals - oocytes, and they are characterized by motility. Mammalian spermatozoa have a long thread-like body and consist of three parts: a head, a neck and a tail.

The domestic rabbit is appreciated for its lean meat, very rich in protein and great organoleptic quality. He is very prolific. Rational breeding can call on artificial insemination technique [1].

The rabbit, as a typical farm animal, differs from other farm animals in its reproductive characteristics. These differences are observed in the characteristics of reproduction, multiple births and early puberty in rabbits. The first characteristic sign for rabbits is early puberty, high fertility, short gestation period, synchronicity of the lactation period with the gestation period, etc [2, 4].

The genital organs of rabbits begin to develop in the womb of the female on the 16th day of pregnancy, but after birth the testes develop more slowly than other parts of the body, but from the age of five weeks they begin to grow and develop very rapidly. Accessory glands also actively develop in a similar way, but a little later. Spermatogenesis begins at 40-50 days, convoluted and straight testicular tubules become active at 84 days, and the first sperm is present in the ejaculate at approximately 100-110 days. In sexually mature male rabbits, the formation of germ cells occurs continuously, and after 4.5-5 years of age, their formation decreases significantly. When mating, a male rabbit releases 0.5-1.5 cm3 of ejaculate, and well-groomed ones - 2-3 cm3 of ejaculate [5, 6].

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Of no small importance is the determination of the morphometric parameters of spermatozoa in sperm obtained from rabbits with its activity. Because the shape and structure of the sperm to a certain extent affects its activity. Many domestic scientific sources have practically not researched information about the morphometric parameters of rabbit spermatozoa in sperm and their changes with age [3].

2. Materials and Methods

The research were conducted on bucks of the New Zealand white breed kept in the vivarium of the Samarkand state university of veterinary medicine, livestock and biotechnology. Three age groups of rabbits were formed, 5 animals in each group. The first group contained one-year-old rabbits; the second group from 2 to 3 years of age; third group aged over 3 years. The sperm was collected using an artificial vagina by placing the doe rabbit in the buck cage. Taking a drop of sperm sample onto a glass slide, add 2-3 drops of a 5% eosin solution (colored pink) and quickly mix. Then a thin smear was prepared. From each group, 5 smears were prepared and 5 (total 5*5=25) spermatozoa were measured. We measured the morphometric parameters of only living (unstained pink) spermatozoa located along a relatively straight line in a dried smear (Figure 1). The following morphometric parameters of spermatozoa were determined: head length; head width; neck-tail length; length of the entire body in micrometers (μm). In addition, the shape of the head (the ratio of the width of the head to the length) and the neck-tail length ratio (the ratio of the length of the neck-tail to the length of the entire body) of spermatozoa were calculated. Each measurement was determined under a microscope (with 10x40 magnification) located in a specially equipped university laboratory "Opta-Tech". The obtained digital data was biometrically processed using mathematical and statistical methods. The limit of options was determined - lim, the arithmetic mean value - $\bar{X}$, the coefficient of variation - Cv%, the error of the arithmetic mean value - Sx, the difference between groups according to the reliability criterion - P was calculated using the corresponding formulas.

3. Results

The numerical data obtained during the research are presented in Table 1. The information in this table shows that the age factor affects the morphometric parameters of rabbit spermatozoa. In particular, in young of bucks (first group), the average length of the spermatozoa head was 9.17 μm, and the widest part of the head was 5.07 μm. The average distance from the neck to the tip of the tail of these spermatozoa was 51.09 μm. The average length of the entire spermatozoa body was 60.26 μm. Calculation of spermatozoa sizes in lobes makes it possible to more fully express morphometric indicators. The proportion of the shape and structure of the head part in the spermatozoa of young bucks was 55.26%, which indicated that the head part has a relatively elongated structure. The percentage of head length relative to the entire spermatozoa perm body was also high, with an average of 15.24%. In terms of the percentage of sperm neck-tail length, a lower indicator was observed in rabbits of this group.

In the experiment, differences were observed in the morphometric parameters of the spermatozoa of the second group of rabbits compared to the first group. In particular, the length of the head was 8.92 μm, which is 0.25 μm or 2.73% ($P>0.05$) shorter than in the first group. The opposite situation was observed for the width of the head. This figure was 5.46 μm, and it was observed that it had a wider structure than the first group by 0.39 μm or 7.69% ($P<0.05$). The distance from the neck of the spermatozoa to the tip of the tail was on average 51.01 μm and did not differ significantly from the first group. The average length of the whole body was 59.93 μm, which is 0.33 μm shorter than in the first group ($P>0.05$). There was also a difference between the morphometric indicators of spermatozoa size, expressed in fractions. In particular, the ratio of head width to head length was 61.30%, which exceeded the first group by 6.04% ($P<0.01$). The percentage of length of the spermatozoa head compared to the whole body was 14.89%, which is 0.35% less than in the first group

(P>0.05). However, in terms of the neck-tail ratio, on the contrary, it was 0.34% (P>0.05) higher.

Figure 1. View of rabbit spermatozoa (10x40)

A difference was also revealed in the morphometric parameters of spermatozoa in relatively old bucks of the third group compared with bucks of the first and second groups. In particular, the average head length was 8.87 μm. Compared to the first and second groups, it has a shorter structure, respectively 0.30 μm or 3.27% (P>0.05) and 0.05 μm or 0.56% (P>0.05). Average head width was 5.34 μm, which was 0.27 μm or 5.33% (P>0.05) more than in the first group, and less by 0.12 μm or 2.20% (P>0.05) than in the second group.

Table 1. Morphometric parameters of spermatozoa in rabbits of different ages (n-25)

Indicators	**lim**	$\bar{X}\pm S_x$	C_v%
First group ♂			
Head length, μm	7,80-11,23	9,17±0,13	6,92
Head width, μm	3,79-6,75	5,07±0,15	14,59
Neck-tail, μm	41,81-56,45	51,09±0,65	6,38
Spermatozoon length, μm	50,76-66,22	60,26±0,69	5,73
Form, %	42,57-68,05	55,26±1,29	11,71
Head, %	13,41-17,64	15,24±0,22	7,34
Neck-tail, %	77,63-91,01	84,76±0,22	1,32
Second group ♂			
Head length, μm	7,89-9,90	8,92±0,12	6,49
Head width, μm	4,49-6,23	5,46±0,09*	8,36
Neck-tail, μm	46,29-56,96	51,01±0,53	5,17

Spermatozoon length, μm	55,13-66,37	59,93±0,55	4,60
Form, %	53,77-69,33	61,30±0,88**	7,21
Head, %	13,18-16,18	14,89±0,20	6,83
Neck-tail, %	83,10-86,66	85,10±0,20	1,20
Third group ♂			
Head length, μm	8,15-10,34	8,87±0,12	6,70
Head width, μm	4,53-6,33	5,34±0,09	8,59
Neck-tail, μm	45,16-53,47	50,20±0,39	3,87
Spermatozoon length, μm	53,76-62,17	59,07±0,37	3,16
Form, %	47,87-73,56	60,46±1,21**	10,00
Head, %	13,31-18,47	15,02±0,22	7,47
Neck-tail, %	81,53-86,69	85,10±0,20	1,20

Note: *P<0.05; **P<0.01

The length of the neck-tail of spermatozoa was 50.20 μm; compared with the first and second groups, shortening was observed, respectively, by 0.89 μm or 1.74% (P>0.05) and 0.81 μm or 1.59% (P >0.05). The same trend was observed in body length, which turned out to be shorter by 1.19 μm or 1.97% (P>0.05) and 0.86 μm or 1.43% (P>0.05), respectively. The percentage of spermatozoa head shape in bucks of the third group was 5.2% greater (P<0.01) than in the first group, and 0.84% (P>0.05) less than in the second group. The percentage of spermatozoa head length was 15.02%, which was 0.22% (P>0.05) less than in the first group, and the percentage of the neck-tail was 0.34% (P>0.05) greater. Compared to the second group, the proportion of the head was 0.13% (P>0.05) larger, and the same figure was noted in the neck-tail part.

4. Discussion

Analysis of the results obtained shows that the morphometric parameters of spermatozoa are influenced by the age factor and change it in one direction or another. Morphometric parameters of spermatozoa of bucks of the first group showed greater variability than in the second and third groups. This indicates that in this group the signs of quantity differ relatively more from each other. For example, lim of the width of the spermatozoa head was 2.96 μm, and in the second and third groups lim was 1.74 and 1.80 μm, respectively. In turn, the coefficient of variation in groups is respectively 14.58; 8.36 and 8.59%. A lower level of variability is observed in the second group, which indicates the similarity of the morphometric parameters of spermatozoa and uniformity of shape. Based on numerical data, the model of the shape and structure of sperm in groups will look like Figure 2.

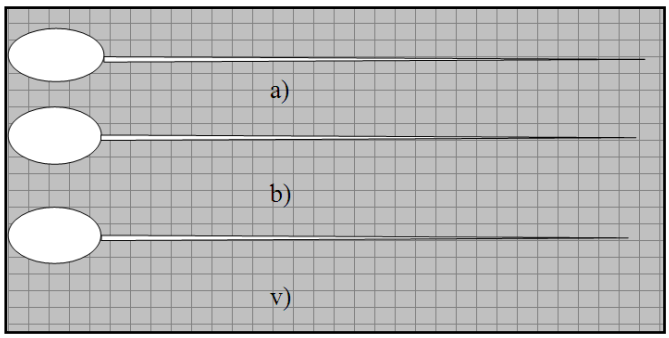

Figure 2. Model of the shape and structure of spermatozoa:
a) 1st group; b) 2nd group; v) 3rd group

5. Conclusion

From the results obtained we can conclude that the age factor affects the morphometric parameters of spermatozoa. Such changes represent a significant difference in the shape of the spermatozoa, especially in the head.

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